DESIGN CRITERIA FOR
WATER LINE CONSTRUCTION

DC5-001 GENERAL. Proposed extensions of the water distribution system shall, in general, follow the pattern of constructing 12-inch water lines along all section lines and 8-inch water lines along all half-section lines. Deviations from this general policy may be deemed necessary by the city engineer should the provision of adequate service to prospective customers or fire protection needs, existing or anticipated, in the area to be served warrant said deviations.

Hydraulic calculations shall be submitted for review with all commercial and industrial plan reviews. Upon request by the City Engineer, hydraulic calculations shall be submitted for review with residential plan reviews.

All commercial and industrial waterlines shall be designed with a minimum of two feed lines (looped system) as determined by the City Engineer. Dead end lines will not be allowed without approval from the City Engineer.

No public water line shall be constructed less than 6 inches in diameter.

DC5-002 LOCATION OF WATER MAINS AND APPURTENANCES. Proposed water mains shall be located within street right-of-way to provide the least interference with the location of other utility lines. Street grades and elevations of proposed main shall be taken into consideration so that once constructed they will not require regrading or relocation.

In residential areas, the water main shall be located 1’ outside the right-of-way within the utility easement.

DC5-003 DEPTH. All water mains shall have a minimum cover of 42 inches (42”).

DC5-004 MATERIALS OF CONSTRUCTION. Polyvinyl chloride (PVC) or ductile iron pipe shall be used for all mains constructed in the City of Gardner.

The PVC pipe shall conform to ASTM D1784, ANSI/AWWA C900. Pipe wall thickness shall be DR-18 for pressure class 150 or DR-14 for pressure class 200.

The ductile iron shall conform to ANSI A21.51; ASTM A536, Grade 60-42-10; AWWA C151. The minimum nominal thickness class for ductile iron pipe shall be 50, unless otherwise designated by the City Engineer. All water mains shall be polyethylene encased and shall conform to ASTM A674.

DC5-005 FIRE HYDRANTS. Fire hydrants shall conform to AWWA C502, and shall be Mueller "Centurion" A-423, Waterous "Pacer" 100, American Darling B-84-B "Quik-Fix," or Kennedy Guardian.

Hydrants shall be traffic models with breakaway flanges and shall have one 4-1/2 inch pumper nozzle and two 2-1/2 inch nozzles. All hydrants shall be furnished with auxiliary gate valves.

Hydrants should be placed at or near street intersections, and at the end of permanent dead end lines (including cul-de-sacs), and at intermediate points when block lengths become long. Under no circumstances shall the spacing of fire hydrants exceed 400 feet in residential areas or 300 feet in commercial areas. Fire hydrant spacing in industrial areas shall be determined by the design engineer and approved by the Codes Administrator.

Fire hydrant installations shall conform to Standard Detail 50-2.

DC5-006 LINE VALVES. Gate valves shall be of the resilient-seated configuration and shall conform to the applicable requirements of AWWA C509.

Resilient-seat gate valves shall be American-80 "CRS" or Mueller A-2370-20 or approved equal.

Gate valves shall be used in all water mains 16-inches (16") in diameter and smaller.

Butterfly valves shall conform to AWWA C504 and shall be Kennedy 50C, American C-1508, Mueller "Line Seal III", or approved equal. Butterfly valves shall be used in mains larger than 16-inches (16") in diameter or where otherwise approved by the city engineer.

Valves shall be placed in all straight runs of pipe at intervals not to exceed 800 feet. Where two lines intersect, a valve should be placed in each pipe on each side of the intersection. Valves should be so placed that any pipe two (2) blocks long can be cut out of the general circulation without interrupting service in the rest of the system. All valves and meters shall be located outside of pavement and proposed and future sidewalks.

DC5-007 CONNECTIONS TO EXISTING WATER MAINS. Connections to existing water mains shall be made in such a manner as to provide the least amount of interruption to water service. In the event closing of valves to make a connection will affect a customer who cannot be without service, provisions shall be made on the plans for a temporary service. Where possible, connections to existing mains shall be made using tapping sleeves and valves as approved in the technical specifications of the City of Gardner.

When connections are made to an existing system under normal conditions, the exposed pipe and fitting interiors shall be wetted with a 500 mg/L chlorine solution before closure. In emergency situations the exposed interiors of the pipe and fittings are to be swabbed with a 1% chlorine solution.

Wetting and or swabbing are not considered effective methods of disinfection when there is a potential for significant contamination of the main, i.e., sewage is detected in the trench during repairs.

DC5-008 PROVISIONS FOR FUTURE EXTENSIONS OF WATER MAINS. At the termination of all water mains or at locations as specified by the City Engineer, a fire hydrant in accordance with Standard Detail 50-2 of the Technical Specifications of the City of Gardner or flushing assembly shall be provided. However, flushing assemblies shall only be used on 6" lines. All lines with a diameter greater than 6" shall terminate with fire hydrant assemblies.

DC5-009 THRUST BLOCKING. All fittings shall be restrained joint unless approved by the City Engineer. All piping within the designed distance of fittings shall be restrained joint in accordance with Table 1. The engineer shall determine and the plans reflect the locations and distances required for the installation of restrained joint piping.

DC5-010 HIGHWAY AND RAILROAD CROSSINGS. All crossings of highways or railroads shall be made by boring or tunneling. Casing pipe shall be greater to or equal to the strength and integrity of the carrier pipe. The installation shall comply to all federal, state, and local regulations. The work shall be in conformity with all requirements and regulations and be under the control of the authority owning or having jurisdiction over and control of the right-of-way in each case.

TABLE 1
THRUST RESTRAINT FOR DUCTILE IRON AND PVC
MAINS AND FITTINGS
FAST GRIP GASKETS

THE THRUST RESTRAINT TABLES ARE BASED UPON THE FOLLOWING CRITERIA:

1. HORIZONTAL FITTINGS ONLY
2. TYPE NO. 2 LAYING CONDITIONS
   - FLAT BOTTOM TRENCH, BACKFILL LIGHTLY CONSOLIDATED TO CENTERLINE OF PIPE.
3. CLAY NO. 1 SOIL CONDITIONS
   - CLAY OF MEDIUM TO LOW PLASTICITY
4. ALL DUCTILE IRON MAINS TO BE POLYWRAPED
5. DEPTH OF COVER 3.5 FEET
6. DESIGN PRESSURE 180 PSI
7. SAFETY FACTOR OF 1.5 TIMES

PLEASE NOTE:

ANY TRENCH, SOIL DEPTH OR PRESSURE CONDITIONS WHICH DEVIATE FROM THE ABOVE LISTED CRITERIA SHOULD BE REVIEWED BY THE CITY ENGINEER FOR AN ALTERNATIVE SOLUTION.

TABLE OF PIPE FOOTAGES REQUIRED TO RESTRAIN FITTINGS BY SIZE					
RESTRAINT FOOTAGE IS FOR EACH SIDE OF FITTING					
FITTING	4"	6"	8"	12"	16"
11 1/4 BEND	5'	7'	9'	13'	17'
22 1/2 BEND	9'	13'	18'	26'	33'
45 BEND	20'	28'	37'	53'	70'
90 BEND	47'	68'	89'	129'	168'
DEAD END	37'	53'	70'	102'	134'

TABLE OF THRUST RESTRAINT FOR TEES					
(RESTRAINT IS ON THE BRANCH ONLY)					
BRANCH SIZE	4"	6"	8"	12"	16"
RESTRAINT LENGTH	37'	53'	70'	102'	134'

TABLE OF THRUST RESTRAINT FOR REDUCERS BY SIZE				
REDUCER-SMALL END	12"	8"	6"	4"
LARGE END				
16"	57'/75'	98'/188'	113'/285'	124'/450'
12"	-	54'/79'	74'/142'	88'/245'
8"	-	-	29'/38'	50'/95'
6"	-	-	-	27'/39'

Example: 16” x 12” reducer requires the following: 57’75’
Length of restrained joint piping for the large side of reducer 57 feet

NOTE: If the straight run of pipe on the small side of reducer exceeds 75 feet them no restrained joints are necessary.

DC5-011 STREET CROSSINGS. Open cutting of streets shall be allowed only where permitted by the City Engineer. At locations where open cutting is not permitted, the crossing shall be made by boring or tunneling. Crossings made by boring or tunneling shall require a casing pipe unless otherwise approved by the city engineer. All work and materials shall be in conformity with all requirements of the technical specifications of the City of Gardner. The diameter and length of the casing pipe to be used shall be as determined by the City Engineer. All casing shall be extended past the right-of-way.

All temporary surfacing shall consist of cold-mix asphalt at a minimum.

DC5-012 BORINGS WITHOUT CASING PIPE Borings without casing pipe is used only with the recommendation of the design engineer and approval of the City Engineer. The bore size shall conform to the following table.

Pipe Size	O.D.	Push-On Joint	Bore Size
6" D.I.P.	6.0	9.13	14"
8" D.I.P.	9.05	11.50	16"
10" D.I.P.	11.10	13.63	18"
12" D.I.P.	13.20	15.75	20"

Sand shall be blown into the bore hole to fill the remaining voids.

DC5-013 FIRE FLOW REQUIREMENTS. The design engineer shall determine the amount of water that is required for fire protection based on I.S.O. guidelines for all waterline projects serving development sites other than single family. The City will assist with on-site flow tests if requested by the design engineer. The design engineer shall calculate the flow requirement and then determine if the existing and proposed waterlines can provide this flow based on existing operating conditions. Calculations verifying that the required flows can be met shall accompany the drawings when submitted for approval. Fire flow requirements will be reviewed by the Codes Administrator.

DC5-014 END OF CUL-DE-SAC. All cul-de-sacs shall be designed in conformance with Technical Specification 5030.

DC5-015 EASEMENTS. Permanent easements must be provided for all water mains. Permanent easements shall be centered on the main. The minimum easement width shall be 10 feet; however, easement widths may be increased depending upon the size of the water main.

DC5-016 MINIMUM SEPARATION FROM OTHER UTILITIES. Water mains in proximity to sanitary sewer mains must meet the minimum horizontal and vertical separation requirements stated in the City of Gardner's Design Criteria for Sanitary Sewer and Appurtenances (DC2).

A minimum horizontal separation of 5 feet shall be provided between the outer wall of water mains and all other utilities. The separation between the outside walls of water mains and all other utilities that are within 10 feet of each other must be labeled on the plans. The utilities shall not be placed in a common trench. In addition, the utilities shall be separated by a minimum of 3’ of undisturbed soil.